



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/520,652	01/07/2005	Hisao Matsutera	204766-9001	5187

1131 7590 03/06/2006

MICHAEL BEST & FRIEDRICH LLP
Two Prudential Plaza
180 North Stetson Avenue, Suite 2000
CHICAGO, IL 60601

EXAMINER

TAYLOR, EARL N

ART UNIT	PAPER NUMBER
----------	--------------

2818

DATE MAILED: 03/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

H1A

Office Action Summary	Application No. 10/520,652	Applicant(s) MATSUTERA ET AL.	
	Examiner Earl N. Taylor	Art Unit 2818	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 7 January 2005 - 12 July 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 10 and 12-15 is/are allowed.
- 6) ☒ Claim(s) 1-5, 7-9, 11 and 16 is/are rejected.
- 7) ☒ Claim(s) 6 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 January 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Priority

Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d).

Information Disclosure Statement

This office acknowledges receipt of the following items from the applicant:
Information Disclosure Statement (IDS) filed on 7 January 2005. The references cited on the PTOL 1449 form have been considered.

Claim Objections

Claim 6 is objected to because of the following informalities: Claim 6 defines the thickness of the second portion as t_2 , and then redefines the thickness of the second portion as $(M_2/M_1)*t_2$; based on the applicant's specification and similar claimed subject matter, examiner interprets the instance of "said second portion has a thickness of t_2 " to read --said second pinned layer has a thickness of t_2 --.

Claim 9 is objected to because of the following informalities: Claim 9 recites, "magnetic filed" and should read --magnetic field--.

Appropriate corrections are required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-16 are rejected under 35 U.S.C. 102(b) as being anticipated by Chen et al. (U.S. Pat. 6,233,172 B1).

Referring to Claim 1, Chen discloses, in Fig. 1 and Fig. 7, a magnetic random access memory comprising a plurality of memory cells, each of which comprises: a free layer (30) which has reversible free spontaneous magnetization; a fixed layer (11) which has first fixed spontaneous magnetization fixed in a first direction; and a spacer layer (16) formed of non-magnetic material and interposed between said free layer (30) and said fixed layer (11), wherein magnetic fields by said fixed layer (11) due to orange peel effect and magneto-static coupling effect are substantially cancelled in said free layer (30) (Col. 2, lines 44-47; Col. 3, lines 6-10 and 21-30; Col. 7, lines 35-52).

Referring to Claim 2, Chen discloses all of the limitations of Claim 1, wherein said fixed layer (11) comprises: a first pinned layer (24) which has second fixed spontaneous magnetization into a second direction opposite to said first direction of said first fixed spontaneous magnetization; and a second pinned layer (28) which is provided between said first pinned layer (24) and said free layer (30) and has said first fixed spontaneous magnetization, and said first pinned layer (24) and said second pinned layer (28) are formed such that magnetic fields by said fixed layer (11) due to the orange peel effect

Art Unit: 2818

and the magneto-static coupling effect are substantially canceled in said free layer (30) (abstract; Col. 2, lines 44-47; Col. 3, lines 6-10 and 21-30; Col. 7, lines 35-52).

Referring to Claim 3, Chen discloses all of the limitations of Claims 1 and 2, wherein a summation of a first magnetic field applied to said free layer (30) by said first pinned layer (24) due to the orange peel effect and a second magnetic field applied to said free layer (30) by said second pinned layer (28) due to the orange peel effect is substantially zero (abstract; Col. 2, lines 44-47; Col. 3, lines 6-10 and 21-30; Col. 7, lines 35-52).

Referring to Claim 4, Chen discloses all of the limitations of Claims 1 and 2, wherein said fixed layer (11) further comprises: another spacer layer (26) of non-magnetic material interposed between said first pinned layer (24) and said second pinned layer (28), and said another spacer layer (26) has a film thickness such that said first fixed spontaneous magnetization and said second fixed spontaneous magnetization are anti-ferromagnetically coupled (Col. 4, lines 12-15).

Referring to Claim 5, Chen discloses all of the limitations of Claims 1 and 2, wherein, in Fig. 2, said fixed layer (11') is provided to extend in said first direction, and each of ends of said fixed layer (11') and said free layer (30') is separated such that a magnetic field generated by magnetic poles produced in said ends does not interlink with a magnetic field due to free spontaneous magnetization of said free layer (30').

Referring to Claim 7, Chen discloses a magnetic random access memory comprising a plurality of memory cells, each of which comprises: a free layer (30) which has reversible free spontaneous magnetization; a synthetic ferrimagnetic fixed layer

Art Unit: 2818

(11); and a spacer layer (16) of non-magnetic material interposed between said free layer (30) and said synthetic ferrimagnetic fixed layer (11), wherein said synthetic ferrimagnetic fixed layer (11) comprises: a first pinned layer (24) which has first fixed spontaneous magnetization fixed in a first direction; and a second pinned layer (28) provided between said free layer (30) and said first pinned layer (27) to have second fixed spontaneous magnetization fixed in a second direction which is opposite to said first direction, and a summation of a first magnetic field applied to said free layer (30) by said first pinned layer (24) due to orange peel effect and orange peel effect and a second magnetic field applied to said free layer (30) by said second pinned layer (28) is substantially zero (abstract; Col. 2, lines 44-47; Col. 3, lines 6-10 and 21-30; Col. 7, lines 35-52).

Referring to Claim 8, Chen discloses all of the limitations of Claim 7, wherein said synthetic ferrimagnetic fixed layer (11) comprises; another spacer layer (26) of non-magnetic material provided between said first pinned layer (24) and said second pinned layer (28), and said another spacer layer (26) has a film thickness such that said first fixed spontaneous magnetization and said second fixed spontaneous magnetization are anti-ferromagnetically coupled (Col. 4, lines 12-15).

Referring to Claim 9, Chen discloses a magnetic random access memory comprising a plurality of memory cells, each of which comprises: a free layer (30) which has reversible free spontaneous magnetization; a fixed layer (11') which has first fixed spontaneous magnetization fixed in a first direction; and a spacer layer (16') formed of non-magnetic material interposed between said free layer (30') and said fixed layer

Art Unit: 2818

(11'), wherein said fixed layer (11') is provided to extend in said first direction, and each of ends of said fixed layer (11') and said free layer (30') is separated such that a magnetic field generated by magnetic poles in the ends does not interlink with a magnetic field of said free layer (30') due to said free spontaneous magnetization.

Referring to Claim 11, Chen discloses a magnetic random access memory comprising a plurality of memory cells, each of which comprises: a free layer (30) which has reversible free spontaneous magnetization; a synthetic ferrimagnetic fixed layer (11); and a spacer layer (16) of non-magnetic material interposed between said free layer (30) and said synthetic ferrimagnetic fixed layer (11), wherein said synthetic ferrimagnetic fixed layer (11) comprises: a first pinned layer (24) which has first fixed spontaneous magnetization fixed in a first direction; and a second pinned layer (28) provided between said spacer layer (16) and said first pinned layer (24) to have second fixed spontaneous magnetization in a second direction which is opposite to said first direction, and said first fixed spontaneous magnetization, said second fixed spontaneous magnetization, a film thickness of said first pinned layer (24) and a film thickness of said second pinned layer (28) are determined such that a magnetic field applied to said free layer (30) by said synthetic ferrimagnetic fixed layer (11) due to orange peel effect and a magnetic field applied to said free layer (30) by said synthetic ferrimagnetic fixed layer (11) due to magneto-static coupling effect are 10 (Oe) or below.

Referring to Claim 16, Chen discloses all of the limitations of Claim 1 wherein said spacer layer (16) is formed of non-magnetic and insulating material, and a

Art Unit: 2818

thickness of said spacer layer (16) is thin to an extent that a tunnel current flows in a thickness direction (Col. 3 lines 55-56; Col. 4, lines 32-35).

Allowable Subject Matter

Claim 6 would be allowable if rewritten or amended to overcome the objection, set forth in this Office action. The following is an examiner's statement of reasons for allowance:

Referring to Claim 6, the prior art taken alone or in combination neither discloses nor makes obvious the instant device as a whole in so far as definite. Specifically, the prior art fails to teach or disclose a magnetic random access memory wherein the first pinned layer comprises: a first portion provided to extend said first direction; and a second portion formed on said first portion such that said second portion is aligned in position with said second pinned layer in a direction perpendicular to a surface of a substrate on which said magnetic random access memory is formed, said first pinned layer and said second pinned layer are formed such that said synthetic ferrimagnetic fixed layer does not substantially influence on said free layer due to orange peel effect, when said first fixed spontaneous magnetization is M_1 said second fixed spontaneous magnetization is M_2 and said *second pinned layer* has a thickness of t_2 , said second portion is formed to have a thickness of $(M_2/M_1)*t_2$, and said synthetic ferrimagnetic fixed layer is formed such that said synthetic ferromagnetic fixed layer does not substantially give influence of the magneto-static coupling effect to said free layer in combination with the limitations of Claim 6.

As allowable subject matter has been indicated, applicant's reply must either comply with all formal requirements or specifically traverse each requirement not complied with. See 37 CFR 1.111(b) and MPEP § 707.07(a).

Claims 10 and 12-15 are allowed. The following is an examiner's statement of reasons for allowance:

Referring to Claim 10, the prior art taken alone or in combination neither discloses nor makes obvious the instant device as a whole. Specifically, the prior art fails to teach or disclose a magnetic random access memory wherein the first pinned layer comprises: a first portion provided to extend said first direction; and a second portion formed on said first portion such that said second portion is aligned in position with said second pinned layer in a direction perpendicular to a surface of a substrate on which said magnetic random access memory is formed, and when said first fixed spontaneous magnetization is M_1 , said second fixed spontaneous magnetization is M_2 and a thickness of said second pinned layer is t_2 , said second portion has a thickness substantially equal to $(M_2/M_1)*t_2$ in combination with the limitations of Claim 10.

Referring to Claim 12, the prior art taken alone or in combination neither discloses nor makes obvious the instant device as a whole. Specifically, the prior art fails to teach or disclose a magnetic random access memory wherein first fixed spontaneous magnetization M_1 , said second fixed spontaneous magnetization M_2 , a film thickness t_1 of said first pinned layer and a film thickness t_2 of said second pinned layer are determined to satisfy the following equation:

Art Unit: 2818

$$\frac{M_1}{M_2} \cdot \frac{t_1}{t_2} > 1$$

Chen states the equation above in a different form; "the product of M_1T_1 needs to be larger than M_2T_2 " is equivalent to the equation above (Col. 4, lines 49-62). However, Chen teaches that M_1T_1 are properties of the second pinned layer not the first pinned layer.

Referring to Claim 13, the prior art taken alone or in combination neither discloses nor makes obvious the instant device as a whole all of the limitations of Claim 12 wherein said M_1 and said M_2 are substantively equal to each other.

Referring to Claim 14, the prior art taken alone or in combination neither discloses nor makes obvious the instant device as a whole wherein said first pinned layer and said second pinned layer are formed of some material in combination with all of the limitations of Claim 12.

Referring to Claim 15, the prior art taken alone or in combination neither discloses nor makes obvious the instant device as a whole wherein the following equation: $M_1 > M_2$ is satisfied in combination with all of the limitations of Claim 12.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Telephone / Fax Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Earl N. Taylor whose telephone number is (571) 272-8894. The examiner can normally be reached on Monday-Friday from 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms can be reached on (571) 272-1787. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Examiner: Earl N. Taylor


David Nelms
Supervisory Patent Examiner
Technology Center 2800